WHAT IS CLAIMED IS:

1      1.      A program storage device, comprising:

2      program instructions executable by a processing device to perform operations for

3   estimating motion trials in video image sequences, the operations comprising:

4          providing data points representing information from an image sequence; and

5          performing regression clustering using a K-Harmonic Means function to cluster the

6   data points and to provide motion information regarding the data points.

1      2.      The program storage device of claim 1, wherein the performing regression

2   clustering using the K-Harmonic Means function to cluster the data points and to provide

3   motion information regarding the data points further comprises providing motion vectors for

4   the data points.

1      3.      The program storage device of claim 1, wherein the performing regression

2   clustering using the K-Harmonic Means function to cluster the data points and to provide

3   motion information regarding the data points further comprises providing at least one motion

4   path for the data points.

1    4.    The program storage device of claim 1, wherein the performing regression

2    clustering further comprises:

3        selecting a number of regression clusters, K, for data points from an image sequence;

4        initializing regression functions for each of the K clusters to estimate the centers of

5    motion for the data points;

6        calculating the distances from each data point to each of the K regression functions;

7        calculating a membership probability and a weighting factor for each data point based

8    on distances between the K regression functions and each data point;

9        applying regression clustering using a K-Harmonic Means function to recalculate the

10    K regression functions;

11        comparing a change in membership probability and a change in the K regression

12    function to a predetermined threshold; and

13        using motion paths represented by the K regression functions when the change in

14    membership probability and change in the K regression function are less than a

15    predetermined threshold.


1    5.    The program storage device of claim 4, wherein the initializing regression

2    functions for each of the K clusters further comprises randomly initializing regression

3    functions for each of the K clusters.

1      6.      The program storage device of claim 4, wherein the program instructions

2    further include instructions for performing the operations comprising repeating the

3    calculating the distances, the calculating membership probability and weighting factors, and

4    applying regression clustering until the change in membership probability and change in the

5    K regression function is not less than the predetermined threshold.

1      7.      The program storage device of claim 4, wherein the weighting factor is chosen

2    to allow the K regression functions to be optimized with less sensitivity to initialization of the

3    K regression functions.

1      8.      The program storage device of claim 4 further comprising extracting data

2    according to a predetermined criteria to provide the data points.

1      9.      The program storage device of claim 8, wherein the extracting data according

2    to the criteria comprises portioning data according to color.

1      10.     The program storage device of claim 4, wherein the program instructions

2    further include instructions for performing the operations comprising preparing each of the

3    data points as x-y-coordinate data points.

1      11.     The program storage device of claim 4, wherein the program instructions

2    further include instructions for performing the operations comprising using the K regression

3    functions to render the image sequence with motion paths shown on a display.

1        12.     The program storage device of claim 11, wherein the using the K regression

2   functions to render the image sequence further comprises overlaying the K regression

3   functions on the video images to show motion between the image sequences.

1        13.     A system for estimating motion trials in video image sequences, comprising:

2        an image sequence retrieval module for retrieving a current image and a first

3   reference image and providing data points representing information from the current image

4   and the first reference image; and

5        a motion estimator, coupled to the image sequence retrieval module, for performing

6   regression clustering using a K-Harmonic Means function to cluster the data points and to

7   provide motion information regarding the data points.

1        14.     The system of claim 13, wherein the motion information regarding the data

2   points further comprises motion vectors for the data points.

1        15.     The system of claim 13, wherein the motion information regarding the data

2   points further comprises at least one motion path for the data points.

1      16.     The system of claim 13, wherein the motion estimator performs regression

2    clustering by selecting a number of regression clusters, K, for data points from an image

3    sequence, initializing regression functions for each of the K clusters to estimate the centers of

4    motion for the data points, calculating the distances from each data point to each of the K

5    regression functions, calculating a membership probability and a weighting factor for each

6    data point based on distances between the K regression functions and each data point,

7    applying regression clustering using a K-Harmonic Means function to recalculate the K

8    regression functions, comparing a change in membership probability and a change in the K

9    regression functions to a predetermined threshold and using motion paths represented by the

10   K regression functions when the change in membership probability and change in the K

11   regression function are less than a predetermined threshold.

1      17.     The system of claim 16, wherein the motion estimator randomly initializes

2    regression functions for each of the K clusters.

1      18.     The system of claim 16, wherein the motion estimator repeats the calculation

2    of the distances, the membership probability and weighting factors, and applies regression

3    clustering until the change in membership probability and change in the K regression

4    function is not less than the predetermined threshold.

1      19.     The system of claim 16, wherein the weighting factor is chosen to allow the K

2    functions to be optimized with less sensitivity to initialization of the K regression functions.

1      20.     The system of claim 16, wherein the motion estimator extracts data according

2    to predetermined criteria.

1    21.    The system of claim 20, wherein the motion estimator extracts data

2    according to color.

1    22.    The system of claim 16, wherein the image sequence retrieval module

2    prepares each of the data points as x-y-coordinate data points.

1    23.    The system of claim 16 further comprising a processor for using the K

2    regression functions to render the image sequence with motion paths shown on a

3    display.

1    24.    The system of claim 23, wherein the processor overlays the K

2    regression functions on the video images to show motion between the current image

3    and the first reference image.

1    25.    A method for estimating motion trials in video image sequences, the

2    method comprising:

3        providing data points representing information from an image sequence; and

4        performing regression clustering using a K-Harmonic Means function to

5    cluster the data points and to provide motion information regarding the data points.

1    26.    The method of claim 25, wherein the performing regression clustering

2  further comprises:

3    selecting a number of regression clusters, K, for data points from an image

4  sequence;

5    initializing regression functions for each of the K clusters to estimate the

6  centers of motion for the data points;

7    calculating the distances from each data point to each of the K regression

8  functions;

9    calculating a membership probability and a weighting factor for each data

10  point based on distances between the K regression functions and each data point;

11    applying regression clustering using a K-Harmonic Means function to

12  recalculate the K regression functions;

13    comparing a change in membership probability and a change in the K

14  regression functions to a predetermined threshold; and

15    using motion paths represented by the K regression functions when the change

16  in membership probability and change in the K regression functions are less than a

17  predetermined threshold.

1    27.    A system for estimating motion trials in video image sequences, comprising:

2    means for retrieving a current image and a first reference image and providing data

3  points representing information from the current image and the first reference image; and

4    means for performing regression clustering, coupled to the means for retrieving and

5  providing, wherein the means for performing regression clustering uses a K-Harmonic Means

6  function to cluster the data points and to provide motion information regarding the data

7  points.


1    28.    The system of claim 27, wherein the means for performing regression

2  clustering further comprises means for selecting a number of regression clusters, K, for data

3  points from an image sequence, means for initializing regression functions for each of the K

4  clusters to estimate the centers of motion for the data points, means for calculating the

5  distances from each data point to each of the K regression functions, means for calculating a

6  membership probability and a weighting factor for each data point based on distances

7  between the K regression functions and each data point, means for applying regression

8  clustering using a K-Harmonic Means function to recalculate the K regression functions,

9  means for comparing a change in membership probability and a change in the K regression

10  functions to a predetermined threshold and means for using motion paths represented by the

11  K regression functions when the change in membership probability and change in the K

12  regression functions are less than a predetermined threshold.

1    29.    A system for estimating motion trials in video image sequences, comprising:

2    means for storing a current image and a first reference image;

3    means, coupled to the means for storing, for retrieving and providing data points

4    representing information from the current image and the first reference image; and

5    means, coupled to the means for retrieving, for performing regression clustering using

6    a K-Harmonic Means function to cluster the data points and to provide motion information

7    regarding the data points.


1    30.    The system of claim 29, wherein the means for performing regression

2    clustering further comprises:

3    means for selecting a number of regression clusters, K, for data points from an image

4    sequence,

5    means for initializing regression functions for each of the K clusters to estimate the

6    centers of motion for the data points,

7    means for calculating the distances from each data point to each of the K regression

8    functions,

9    means for calculating a membership probability and a weighting factor for each data

10    point based on distances between the K regression functions and each data point,

11    means for applying regression clustering using a K-Harmonic Means function to

12    recalculate the K regression functions,

13    means for comparing a change in membership probability and a change in the K

14    regression functions to a predetermined threshold; and

15    means for using motion paths represented by the K regression functions when the

16    change in membership probability and change in the K regression functions are less than a

17    predetermined threshold.